

## Comparison of properties of lightweight concrete given in DIN EN 1520 with those given in DIN 4028, DIN 4232 and DIN 1045-1

### Summary

Due to the introduction of DIN EN 1520 the possible field of applications of lightweight aggregate concrete with open structure will be extended significantly compared to its preceding German standards DIN 4028 and DIN 4232. Deviating new standards for the determination of the strength values of lightweight aggregate concrete with open structure are a further novelty. These changes form the background for a comparison of concrete properties such as density, compressive strength, flexural tensile strength, stress-strain diagram, Young's modulus, Poisson's ratio, thermal expansion coefficient, shrinkage and creep of lightweight aggregate concrete with open structure on the one hand and structural lightweight concrete on the other. The comparison was based on DIN EN 1520 and its preceding standards DIN 4028 and DIN 4232 for lightweight aggregate concrete with open structure. DIN 1045-1 was used for the comparison with structural lightweight concrete. Additionally the properties given in DIN EN 1520 were compared with test results provided by producers and complemented by own test results.

The investigation revealed the following results:

- Definitions for the density classes are identical throughout the standards.
- The conversion factor for compressive strength given in DIN EN 1520 either coincide in some cases with the few test results available or lead to a rather conservative prediction. Inconsistencies were disclosed in comparison with DIN 1045-1 regarding the different conversion factors between cubes and cylinders.
- The computed values of the flexural tensile strength as given in DIN EN 1520 yield very conservative predictions compared to actual test results. A similar approach in DIN 1045-1 differs by approximately 10 % from the prognosis based on DIN EN 1520.
- Experimentally determined stress-strain diagrams of lightweight aggregate concrete with open structure exhibit a slightly convex shape of the ascending branch while the standard assumes a linear stress-strain relationship.
- The calculated values of Young's modulus are very conservative. Partly they reach only 20 % to 50 % of the measured test results.
- The information on Poisson's ratio and thermal expansion coefficient are concordant with the other standards as far as they are mentioned.
- The few shrinkage test results available and the comparison with the terms valid for structural lightweight concrete indicate that predicted shrinkage is overestimated significantly. DIN EN 1520 ignores the influence of the type of cement on shrinkage.
- Creep of lightweight aggregate concrete with open structure has hardly been investigated. But, these existing results exceed the predicted ultimate creep clearly. More information is needed for the next generation of the standard to achieve a save prediction of creep.